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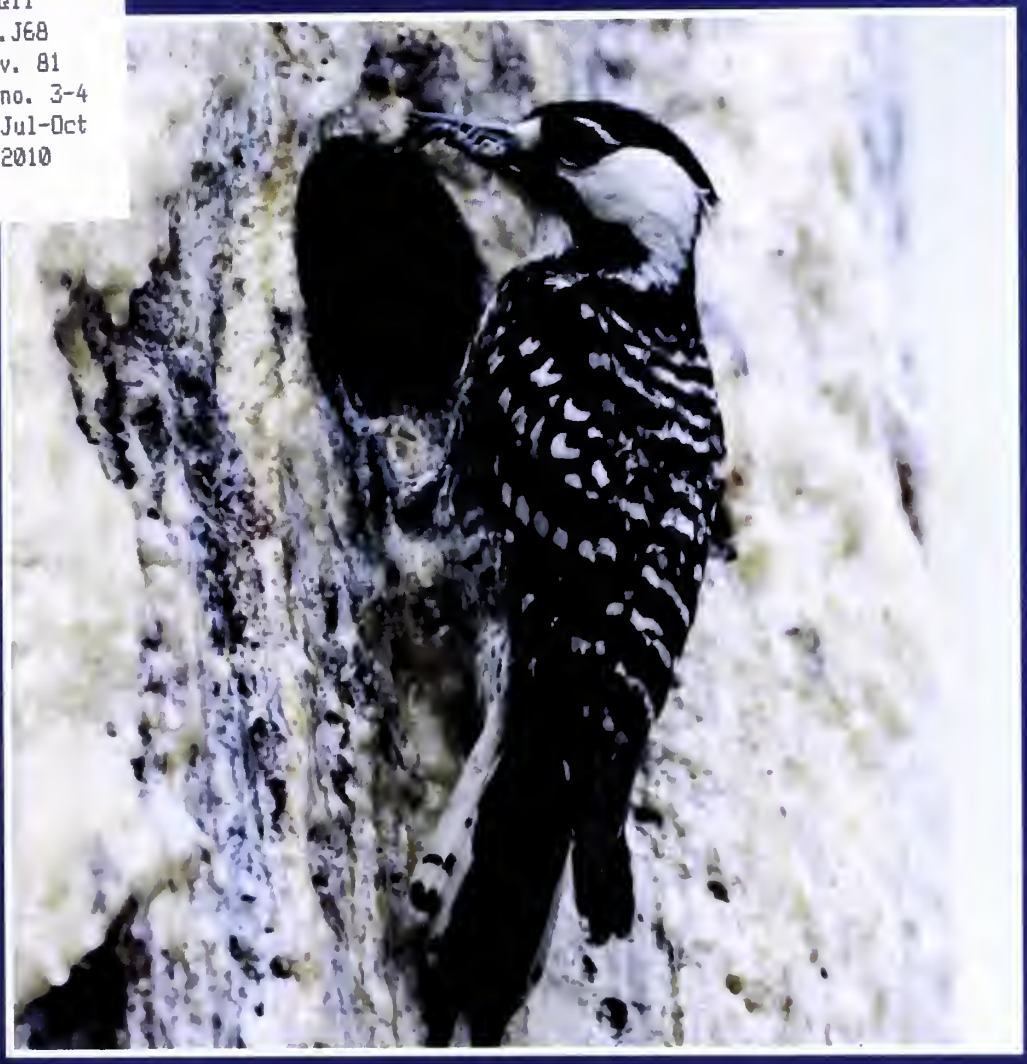

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Cover Photograph: Red-cockaded Woodpecker: Endangered Keystone Species of mature longleaf pine forests.

Photo is courtesy of: Bill Garland, U.S. Fish and Wildlife Service, Biologist, Anniston, Alabama. Photo was taken at Talladega National Forest, Alabama.

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CONTENTS

USE OF CULVERTS AS DIURNAL ROOST BY BATS IN BUTLER CO, ALABAMA

Michael J. Bender[1,*], Steven B. Castleberry[1], Darren A. Miller[2], and T. Bently Wigley[3]

[1] Daniel B. Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia 30602. [2] Weyerhaeuser NR Company, P.O. Box 2288, Columbus, MS 39701. [3] National Council for Air and Stream Improvement Inc., P.O. Box 340317, Clemson, SC 29634.
[*] Corresponding author - benderm@warnell.uga.edu

ABSTRACT

We observed Southeastern myotis (*Myotis austroriparius*), Big brown (*Eptesicus fuscus*), and Brazilian free-tailed bats (*Tadarida brasiliensis*) using concrete box culverts as diurnal roosts in Butler County, Alabama during summer 2008. All occupied culverts were near water and contained weep holes used as roosting locations. Culverts had much shorter lengths than previously published dimensions of occupied culverts and would typically be overlooked in bridge surveys. Our observations suggest that culverts may be important roost structures for multiple bat species in this region however, a large scale survey is required to better understand culvert importance.

INTRODUCTION

The Alabama Department of Conservation and Natural Resources has designated 8 bat species as "high-highest" conservation concern, most of which potentially inhabit the Coastal Plain physiographic region (Alabama Department of Conservation and Natural Resources 2008). These conservation designations are based on a combination of rarity, limited distribution, population viability, and specialized habitat requirements that are vulnerable to natural and anthropogenic forces (Mirarchi 2004). However, little is known about the distribution, population, or threats to many high priority bats across the state (Best et al. 2004) and conservation efforts are inefficient without these data (Racey and Entwistle 2003).

Bridges and culverts are used as roosts by many bat species throughout the United States, including species of conservation concern (LaVal 1967, Humphrey and Gore 1992, Keeley and Tuttle 1999, Trousdale and Beckett 2004). These structures may be critical habitat for species that historically relied on natural roosts, and some species may be seasonally dependent on anthropogenic roosts in landscapes with limited natural roosting alternatives (Trousdale et al. 2008). Use of anthropogenic structures as roosts indicates behavioral plasticity and may be related to the degree of structural permanence, thermoregulatory benefits, availability and abundance of alternative roosts, and surrounding landscape

characteristics (Kunz 1982, Lance et al. 2001). Data obtained from occupied bridges and culverts may reveal their importance to the regional distribution of many species, and characteristics of occupied structures provide useful information to researchers attempting to create or modify anthropogenic roosting structures (Arnett and Hayes 2000).

While conducting a mist net survey as part of a larger research project, we observed bats that appeared to be using a nearby road culvert as a roost. We later examined that culvert, and additional culverts, as a general indication of culvert use, and to assess the efficacy of diurnal culvert surveys as a sampling method.

MATERIALS AND METHODS

We opportunistically examined four culverts in Butler County between 25 May and 16 June, 2008 Butler County lies in the south-central portion of Alabama within the Coastal Plain physiographic region. The local landscape consists primarily of intensively managed pine plantations, but included agricultural and low-density residential property. This landscape composition is representative of the Southeastern Plains region (United States Geological Survey 2008).

Culverts were examined once and were chosen based on proximity to areas that were being sampled for a larger research project. Three culverts were located within a 1 km section of County Road 30 (CR-30) and the remaining culvert was approximately 20 km distant on County Road 18 (CR-18). We used spotlights and headlamps to examine culverts during the day and noted locations of roosting bats and signs of previous use (including presence of guano or urine stains; Thomas and LaVal 1988).

RESULTS

Three of four examined culverts were used as diurnal roosts (CR-18 culvert and two CR-30 culverts) by three species. We confirmed identities of an adult male *Myotis austroriparius* Rhoads (Southeastern myotis) and an adult male *Eptesicus fuscus* Beauvois (Big brown bat) by hand capture, and we identified a *Tadarida brasiliensis* Geoffroy (Brazilian free-tailed bat) visually. Occupied culverts varied in number of roosting species and individuals. The culvert on CR-18 housed at least five Southeastern myotis. One occupied culvert on CR-30 contained one Southeastern myotis, one Big brown, and an unidentified individual. Another culvert housed two Southeastern myotis, one Big brown, and one Brazilian free-tail. Occupied crevices never appeared to contain more than two individuals, but additional bats may have occupied some of the crevices that were difficult to examine. Big brown bats roosted singly, and the Brazilian free-tailed bat shared its crevice with one Southeastern myotis. Southeastern myotis primarily roosted singly, but some crevices were shared by two individuals.

Figure 1. Concrete road culvert used as a diurnal roost by bats in Butler County, Alabama.

Figure 2. Typical weep hole used as a diurnal roost in Butler County, Alabama.

All occupied culverts were reinforced concrete cast-in-place box culverts (Figure 1) containing weep holes (Robert Estes, Chief Bridge Inspector, Alabama Department of Transportation (DOT), Pers. Comm.) which were used as roosting locations (Figure 2). Weep hole crevices were uniformly 7.6 cm in diameter at the culvert ceiling and were

approximately 20.3 - 30 cm deep. Corrosion appeared to have expanded some weep holes in depth and diameter in portions proximal to the culvert ceiling. Some occupied weep holes were partly obstructed by active and abandoned mud dauber nests (Order Hymenoptera, Family Sphecidae). Occupied culvert dimensions varied from 13 to 19 m long, 3.0 – 3.7 m wide, and 1 to 4 m above ground or water. Only one weep hole was occupied or showed signs of occupancy when height was less than 1.5 m. All occupied culverts had water in the immediate vicinity, but not all occupied weep holes were above water. Water types included stagnant pools and narrow (3.5 – 9 m) flowing streams. Water was always shallow (5.0 to 30.5 cm), had minimal if any flow, and often consisted of disconnected pools with suspended sediment and surface film. The unoccupied culvert was similar in size and construction however, it did not contain weep holes or any crevices.

DISCUSSION

Two culvert inhabitants of Butler County (Brazilian free-tailed bats and Southeastern myotis) are designated with a high conservation status in Alabama (Alabama Department of Conservation and Natural Resources 2008), yet little is known about their summer habitat requirements, particularly the Southeastern myotis (Reynolds and Mitchell 1998). Although Southeastern myotis have been documented using culverts as roosts across much of the Southeast (Florida, Humphrey and Gore 1992; Mississippi, Martin et al. 2005; Texas, Mirowsky et al. 2004, Walker et al. 1996), few data on characteristics of occupied culverts are available. Occupied culverts in Butler County, Alabama had characteristics similar to, although substantially shorter lengths than, published data from culverts elsewhere occupied by Southeastern myotis and other bat species (Walker et al. 1996, Keeley and Tuttle 1999, Martin et al. 2005). Occupied culverts in Butler Co. were less than one-third the length of previously documented culvert roosts and it is possible that researchers conducting structure surveys based on previously published data would overlook these smaller culverts or characterize them as unsuitable roosting habitat based on their less than "ideal" characteristics (Keeley and Tuttle 1999).

The limited scope of our observations precludes our ability to make absolute conclusions regarding the importance of culverts as diurnal roosts. However, culvert and bridge surveys should be considered as viable methods to supplement the dearth of data concerning bats in Alabama, particularly within the Coastal Plain. Butler County contains 27 state-owned culverts similar to those occupied, and the nine county Alabama DOT region containing Butler Co. has 246 similar state-owned culverts (Robert Estes, Alabama DOT, Pers. Comm.). This prevalence of culverts across the landscape may influence species distributions in the region, particularly if roost sites are a limiting factor. Further surveys should be designed so that the temporal, geographic, structural, and landscape effects on culvert occupancy can be estimated.

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THE END OF SCIENCE

Gerard Elfstrom

Department of Philosophy
Auburn University
6080 Haley Center
Auburn, Alabama 36849-5210
elfstga@auburn.edu

ABSTRACT

In recent years, there has been considerable discussion of whether science will come to an end, not in the sense that humans will turn to other activities or become hostile to scientific investigation, but in the sense that science will accomplish all its goals and thus be complete. That question does not arise when discussing history, literature, or philosophy. Hence, there must be something about scientific endeavor that allows for the possibility that scientists will achieve all their goals and move on to other activities. This paper will examine the issues of what features of scientific activity make this possibility of completion seem reasonable and whether there is any good reason to believe that scientists will ever be able to achieve that end.

INTRODUCTION

The word 'end' in the title is deliberately ambiguous. It refers both to the goals of scientific activity and the possibility that science may someday achieve its goals and cease to function. Since the era of the Greek philosophers, learned and intelligent people have believed that the sciences *can*, in theory at least, achieve all their aims and thus be complete. In recent decades, the topic of the possible end of the sciences has prompted lively controversy. A book by science writer John Horgan titled *The End of Science* proclaims that the sciences are already at an end, or nearly so (Horgan, 1996). However, he asserts that most of the sciences he examines are fizzling out because of human limitations, not because they have achieved all their goals. A more optimistic view has also been afloat for several years. A number of notable scientists, including Stephen Hawking and Steven Weinberg, have proclaimed that physicists were closing in on a "final theory," a theory that would complete the theoretical edifice of physics and thus bring physics to a close in a critically important way (Hawking, 1998; Weinberg, 1992).

In this regard, the sciences are sharply distinct from other pursuits such as literature, music, history, or philosophy. These disciplines lack the sense that they must address a limited set of questions or that they will be complete once these questions are answered. Instead, these activities will likely continue so long as human beings are inclined

to pursue them. Philosophers still happily argue about questions first introduced by the ancient Greeks. Literature and the plastic arts continue to reshape and reorient themselves.

But the above suggests two questions: What, precisely, are the goals of the sciences, and is there reason to believe that scientists will someday attain these goals? Though the conclusions of this essay have implications for all sciences, it will focus primarily on physics because discussions of the possibility of a final theory have taken place largely within the domain of physies.

The Goals of the Sciences

The answer to the first question may seem trivial: Scientists wish to understand their subject matter. But in the 21st Century, it is unelear what this means. For thousands of years, the practitioners of the sciences believed they knew what it meant: The goal is to formulate a set of principles that will allow the practitioners of science to explain all the phenomena in their arena of inquiry (Weinberg, 1992, pp. 7-18). Hence, in Aristotle's view, the goal of the science of physics is to formulate the fundamental principles that would allow him to explain the changes of physical bodies. Once the relevant principles are in hand and the relevant explanations devised, the science of physics would have done its work. As he put it, "When the objects of an inquiry, in any department, have principles, causes, or elements, it is through acquaintance with these that knowledge and understanding is attained" (Aristotle, 1950, p. 315). All that would remain is the task of transmitting that information to future generations. *That* view of the goal of science, the goal of formulating a set of ultimate principles, has resounded through Western European intellectual history.

Echoes of the Classical view have returned in the last several decades. Among others, both Stephen Hawking and Steven Weinberg have proclaimed that the ultimate theory of physics is in the offing. Their thinking is (roughly) as follows: In the past century, physicists have identified the four fundamental forces of nature, the strong atomic force, the weak atomic force, electromagnetism, and gravity. They have also identified the fundamental particles of nature, including electrons and the several types of quarks, as well as the carriers of the fundamental forces. Over the decades, physical scientists have devised theories to explain the ways in which the fundamental particles are related to one another and different theories to explain the ways in which three of the four fundamental forces are related to one another. That is, they have a clear grasp of the ties between the strong atomic force, the weak atomic force, and electromagnetism. However, they are not as yet able to fathom how gravity is related to the other three forces. So Hawking and Weinberg's hope for a final theory amounts to the hope for a theory that will allow an understanding of the relation of gravitation to the other three forces. Once that is in place, the theoretical edifice of physics will be complete (Hawking, 1998).

Of course, neither Hawking nor Weinberg believes this achievement would spell the literal end of physics. Many important questions will remain to vex the next generations of physicists. Nonetheless, Hawking and Weinberg are convinced that the fundamental theoretical edifice of physics will have reached closure. With time and considerable effort, it is not impossible that physicists will also be able to explain all the phenomena relevant

to their discipline. At that point, physics will have come to an end, literally as well as metaphorically.

The Aristotelian view that the goal of science is to construct principles to explain relevant phenomena appeared both attainable and uncomplicated for many years. If there were a fixed, known array of phenomena to be understood, then construction of a theoretical edifice to explain these phenomena would be uncomplicated. However, the Aristotelian view relies on two important assumptions: The world reveals itself completely to human sense experience, and that all of reality can be grasped by unaided human sensation. Those views were shattered during the Scientific Revolution. The telescope allowed humans to gaze out much farther and showed the heavens to be far different than human beings had previously assumed. But when the lenses in the telescope are switched around, it becomes what Galileo referred to as an "inverted telescope," a microscope, in other words (Sennett, p. 196). This "inverted telescope" not only allowed human beings to see in far deeper, it also revealed entirely new, hitherto undreamt-of realms and beings. These extensions of human vision prompted radical changes in the human understanding of the heavens, and exposed entirely new realms of microscopic beings that are invisible to unaided perception. These developments ignited radical changes in scientists' understanding of living beings. The Scientific Revolution also fixed the view that scientific advancement is at the mercy of matters of fact. From that point forward, scientists could not presume to have adequately understood their domains until they could be sure that they had investigated all relevant domains and had command of all relevant facts.

If the above is correct, a science will achieve completion when it has a fundamental theoretical structure in place, is able to explain all relevant phenomena, and there are no additional domains remain for it to investigate. But can we expect the labs to close at that point and scientists to drift into other lines of work? That is possible, but my guess is that the sciences will end neither with a bang nor with a whimper but with a subtle transformation into something else, something like technology. Institutional and professional inertia will keep laboratories running and scientists in place, but the questions scientists seek to address will change. Rather than seeking to uncover new knowledge, they will seek to discover ways of doing things that will achieve human goals. Scientists will, in other words, have become practitioners of technology rather than of science. The line between science and technology is increasingly blurred because new discoveries frequently open the way to immediate practical application. At some point, the line may fade completely, and all problems will become problems of technology.

Prospects for Success

If the above picture of the elements of the success in the sciences is correct, we can ask whether it is reasonable to expect any or all of the sciences to achieve that goal. The key to addressing this question is to recognize that it has two aspects. One aspect is nature. There may be something about nature that would prevent scientific understanding from ever reaching completion. The second aspect is the human factor. There may be something about the human activity of scientific investigation that may prevent a science from reaching completion.

Nature

One possibility is that the laws and processes of the universe are continually changing. If so, it is unlikely that any science could keep abreast of the changes or that it could predict the changes to come. While anything is possible, the history of scientific investigation reveals no indication that this will happen.

Another possibility is that a significant number of events and processes in the universe occur completely at random. If so, it may be impossible for the seiences to fathom them. As it happens, science has been contending with this possibility for the better part of a century, for many quantum events on the subatomic level are believed to occur randomly. However, this has not deterred scientists from describing such events in mathematical terms. The American physicist Richard Feyman achieved just this with his theory of quantum chromodynamics. Though the mathematics is entirely successful, Feyman cheerfully admits that he doesn't understand these processes, and he does not believe that anyone can (Feyman, 1988, pp. 9-10). We can ask, then, whether this lack of understanding is a significant limitation of science. It is difficult to say. However, we can wonder whether there are important theoretical questions that cannot be addressed because of this limitation. Further, we can ask whether this lack of understanding is fated to be permanent or whether it will eventually succumb to understanding. This leads the way to the next possibility.

It may also be the case that nature is infinite, not in the spatial sense, but in the sense that there are an infinite number of forces and types of processes in nature. Hence, no matter how many laws are successfully formulated or how many processes are understood, an infinite number will remain to challenge human understanding. Isaac Asimov formulated that possibility in memorable fashion: "I believe that scientific knowledge has fractal properties, that no matter how much we learn, whatever is left, however small it may seem, is just as infinitely complex as the whole was to start with. That, I think, is the secret of the universe" (Asimov, 1995, p. 472). If Asimov is correct, the sciences are doomed to remain incomplete. Recall that Hawking and Weinberg's hope for a final theory of physics rests on the presumption that there are only four fundamental forces in nature. If other forces are discovered, this theory will be dashed, and physics may return to its state at the beginning of the twentieth century. And if there prove to be an infinite number of forces, there will be no end of the laws that must be formulated to explain them. Though this possibility cannot be ruled out, it appears unlikely. If nature holds an infinite number of forces and processes or even an extremely large number of them, scientists would likely encounter new forces or processes on a regular basis. They have not done so. Instead, as Weinberg notes, scientists' accounts of the number of forces have been narrowing in recent history (Weinberg, 1992, p. 6).

In the past several decades, several have developed the argument that Effective Field Theory poses a significant challenge to hopes for a final theory and the hope that physics can reach completion. Basically, Effective Field Theory is a technique that allows researchers to make highly accurate calculations within fixed energy ranges. An upper energy level is chosen, and equations are allowed to give results of infinity above that

level. However, researchers have noticed that there is little continuity of physics from lower energy levels to higher levels. The consequence is that each level must be examined individually to determine how its physics operates (Hartmann, p. 268). Effective Field Theory has been highly useful to researchers for decades and remains an important tool of research. In 1993,Cao and Schweber suggested that it is possible there will be an infinite number of energy levels, each with its own physical processes. Since the investigations will proceed from lower to higher energy levels, they concluded scientists might encounter "an endless tower of theories" (Cao and Schweber, 1993, p. 66). Should that occur, hopes for a final theory would be dashed, and the theoretical work of physics would never come to an end (Cao and Schweber, 1993, p. 65).

Nonetheless, Cao and Schweber never offer a theoretical explanation of why the tower of energy levels should proceed to infinity. They simply present it as an option. Hence, it is possible that the tower will stretch to infinity, but we have no strong grounds to believe that it will do so. It is simply a possibility. Nonetheless, if the tower of Effective Field Theories should reach to infinity, would that imply that physics would never achieve completion? Not necessarily. It is not the case that new particles (or at least not previously unknown particles) or new forces appear at different energy levels. Nor are different fundamental theories needed to understand the physics of each level. The relations of forces and particles need to be calculated anew at each energy level, but it is not the case that basic theories of physics will need to be revised. One recent commentator finds no conflict between Effective Field Theories and hopes for a final theory. In fact, he concludes that Effective Field Theories will be needed for the construction of a final theory (Hartmann, 2001, p. 296).

Yet another difficulty remains. One distinguished scholar, Solomon Feferman, has noted that there are an infinite number of facts. Hence, science can never hope to examine all of them (Feferman, 2004). So the possibility always remains that some new fact or collection of facts will upend our understanding of nature, just as Roentgen's accidental discovery of radiation upended our understanding of the nature of matter. At least one philosopher has argued that it is reasonable to expect that researchers will continue to encounter new facts that undermine established theories. The argument is inductive, grounded on the historical fact that scientists have always encountered new and disruptive facts in the past (Laudan, 1981, 32-34). It is entirely correct that scientists have often stumbled on unexpected and scientifically important facts in the past.

But another important inductive truth is that trends eventually come to an end. Hence, the relevant question is whether the conditions that allowed the generation of novel and disruptive facts in the past will continue. It is important to note that the stunning advances that have taken place from the time of Copernicus have been fueled by technological advances that allowed researchers to investigate nature more thoroughly. In recent decades, telescopes in space, increasingly powerful particle accelerators, and more advanced imaging devices, such as MRIs, scanning-tunneling microscopes, & etc. have allowed discoveries that have amazed scientists and prompted them to recast their most

cherished theories. At present, both researchers and theoreticians would be absolutely delighted by completely unexpected phenomena. It is also the case that the number of scientists at work has exploded in the past 60 years, as has the amount of money dedicated to the support of scientific research. One enthusiastic researcher has asserted that with the successor to the Hubble Space Telescope, the James Webb Space Telescope, "We are going to extraordinary lengths ... to be able to see as far as we will ever see" (Irion, 2010). At that point, scientists will likely put their customary ingenuity to work to employ circumstantial evidence to make inferences about that which lies beyond direct study. Hence, barring lack of funding, scientists can expect to gain confident ideas of the beginning of the universe. The particle accelerator at CERN may well reveal the most fundamental particles of the universe. Advanced imaging devices no allow researchers to create images of individual atoms and watch biological processes as they take place. Given the talent and resources devoted to extending the reach of human understanding, it is reasonable to suppose these efforts will eventually reaeh the point at which no unexpected and disruptive data are encountered.

Hence, though Feferman's premise and first inference are undoubtedly correct, his second inference is far less compelling. It is entirely true, as Feferman recognizes, that scientific theory must remain at the mercy of factual discovery. The view of the ancients, the view that the goal of science is to contrive fundamental explanatory theories, has been kept in check since the days of Galileo. The possibility of unexpected but theory-shattering facts can never be ruled out, but is there reason to expect a significant number of these theory-shattering facts to exist?

Human investigation

Even if there is nothing inherent in nature to prevent the successful completion of a science, there may be inherent limitations of the human activity of science. Recall that many of the great scientific advances have resulted from advances in the human ability to observe, whether farther out or farther in or with far greater precision. Is there reason to believe our ability to observe will stop short of the limits of nature? We know of two such limits and possibly a third. Our ability to see out must end with the Big Bang, the explosive beginning of the universe. Further, it is unlikely we will ever be able to see directly to that point. Our knowledge of the events of the Big Bang must be based on circumstantial evidenee (such as the discovery of the cosmic background radiation left over from the event) and on inference. Nonetheless, there is a limit to what we can know. At the other end of the scale, a number of significant questions about quantum mechanics must be addressed at the level of the Planck Length, or 1.616×10^{-35} meters. At that scale, even an electron is massive, so it seems unlikely we will ever be able to inspect it directly. If so, the limit of our scientific observation may lurk somewhere before the Planck Length. The third, but possible, limit is the prospect of other universes outside our own.

Nonetheless, we ean ask whether it is likely that any significant changes in physical theory are likely to result from these limitations. Some, Hawking among others,

note that physicists are adept at devising indirect tests for phenomena they cannot examine directly (Hawking, 2000). In consequence, the limit of observation may be only the limit of *direct* observation and not of scientific explanation.

Another possible limitation to the human activity of science was presented by Hawking a few years ago. He pointed out that physical science relies on mathematics, but Gödel has demonstrated that mathematical systems must always remain incomplete. Because physical science relies on mathematics, it, too, must remain incomplete (Hawking, 2003). However, this conclusion soon received a simple and devastating response: Physical science does not employ all of mathematics, only a portion of it, and that portion can be demonstrated to be complete (Feferman, 2004).

CONCLUSION

The result of these deliberations is, sadly, inconclusive. There is little reason to believe that some feature of nature will prevent science from achieving completion. However, until human beings arrive at the conclusion that it is impossible for them to see farther out or farther in and determine that the limits of our vision coincide with the limits of nature, we may never know that our sciences are complete. That is, we may never know whether there are any additional critically important facts for us to discover or whether there are other domains to investigate or laws to discover.

ACKNOWLEDGEMENTS

I am indebted to an anonymous reviewer for tough questions that motivated me to think through this project more deeply and for several invaluable suggestions and pointers. Even though the reviewer and I disagree on a number of matters, I have greatly benefited from his or her insights and probing commentary.

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ANALYSIS AND CLASSIFICATION OF THE INTESTINAL MICROBIOTA OF THE SLIMY SALAMANDER BY 16S RIBOSOMAL DNA SEQUENCING

James J. Okelley, Benjie G. Blair, and Christopher Murdock
Department of Biology, Jacksonville State Univeristy, 700 Pelham Road N., Jacksonville, AL 36265, USA

Correspondence: Dr. Benjie Blair:bblair@jsu.edu

ABSTRACT

The microflora in the gastrointestinal tract of amphibians is poorly understood. Analysis of amphibian gut microflora has relied on conventional methods that have been useful in identification of specific groups of cultivable bacteria. In this study we constructed a 16S rDNA clonal library to classify the bacterial species found within the gut of the Slimy Salamander (*Plethodon glutinons*). A total of 49 phylotypes were recovered, and 31% demonstrated sequence similarity to the genera *Clostridium*, 27% were closely related to *Bacteroides*, and 12% were related to the genera *Enbacterium*. Ten percent were related to Enterobacteriacac, and the remaining 20% were related to various obligate anaerobes. This is the first report of a culture independent analysis of intestinal microbial ecology of an amphibian and will establish a baseline for future research.

INTRODUCTION

Assessment of intestinal microbiota diversity in amphibians has received little attention while studies in other vertebrates have utilized conventional culture methods and 16S ribosomal DNA sequencing to address questions concerning microbial communities in vertebrate digestive tracts. Digestive fermentation, along with some data on distribution of intestinal microflora, has been addressed in both amphibians and reptiles (Banas, 1988; Bouchard, 2005; Fedewa, 2006; Pryor, 2005; 2006). However, such data concerning species identification and distribution of amphibian intestinal microflora has been limited to cultivation methods. In reference to amphibian and reptilian digestion, it has been shown that fluctuations in morphology and physiology of amphibian and reptilian digestive tracts occur (e.g., in response to fasting and estivation), thereby possibly stimulating fluctuations in microbial communities in these systems as well. For example, the African Bullfrog (*Pyxicephalus adspersus*) and the South American horned toad (*Ceratophrys ornata*) showed a 78% and 84% reduction respectively in intestinal performance after a one-month fasting period. Reported data also indicated that the Burmese Python (*Python*

molurus) experienced a five-fold increase in the length of the microvilli after ingestion of a food source and then significant reduction of the villi during fasting periods (Secor 2005). Collectively, these studies suggest possible changes in niche opportunities for microbes. A current review of the literature produced no papers in this field since 2006.

This is the first account describing the specific bacterial intestinal microbiota of *Plethodon glutinosus* by 16S rDNA sequencing. This base-line study will provide biologists insight into intestinal microbial ecology of the Plethodontidae. It may prove useful by increasing the understanding of studies covering antimicrobial peptides, which have potential in medicine or account for the presence of certain enzymes found in the digestive tract.

MATERIALS AND METHODS

Model organism

Plethodon glutinosus is a medium-sized, strictly terrestrial salamander that is geographically distributed from the southern sections of New York southward to the north central sections of Florida, including statewide distribution in Alabama (Mount 1975). This particular speeies inhabits rotting logs, along moist ravines and hillsides, and close to small streams and creeks throughout its geographical region feeding mainly on earthworms, grub worms, and various insects, specifically beetles and ants (Conant 1975, Mount 1975).

Salamander capture and intestinal collection

Five specimens of *Plethodon glutinosus* from Calhoun County, Alabama were captured and subsequently euthanized upon return to the laboratory (in accordance with guidelines of the American Society of Ichthyologists and Herpetologists). Tissues for each specimen were taken from the junction of the stomach and small intestinc to the rectal opening.

Four samples (1 gram) of digested intestinal material were aseptically removed from each specimen. Each sample was weighed and mixed with sterile sand (0.5 g per gram of intestinal material) in a sterilized mortar and pestle, covered with liquid nitrogen and ground for one minute. The liquid nitrogen and grinding processes were repeated three times. Thus, macerating the tissue and releasing total cellular contents of the microbes in the samples.

DNA amplification and clonal library construction of intestinal samples

DNA samples were extracted and purified from each of these samples for all five specimens using an Ultra Clean Soil DNA Isolation Kit (MoBio Laboratories, Inc., Solana Beach, CA) and pooled. The pooled intestinal tract DNA samples were then utilized for amplification of the 16S rRNA genes using primers designed to anneal to highly conserved regions within this gene. The bacterial forward primer Bac27F (5-AGAGTTTGATCCTGGCTCAG-3) and universal reverse primer Univ1492R (5-GGTTACCTTGTTACGACTT-3) were used following standard methods (Dojka M.A., et

al. 1998). The PCR products were purified with a GeneClean Turbo kit (Qbiogene Inc., Irvine, CA) according to the manufacturer's suggested protocol.

The PCR products were ligated using the Invitrogen TOPO TA Cloning Kit (Carlsbad, CA) and transformed into *Escherichia coli* DH5α competent cells according to manufacturer's suggested protocols. Gene clone libraries of 16S rRNA were constructed and a minimum of 55 randomly selected colonies were analyzed for insert 16S rRNA gene sequences. Plasmid DNA containing inserts of the 16S rRNA gene was prepared using a QIAprep Spin miniprep kit (QIAGEN, Valencia, CA). Sequencing reactions were performed using the Bac27F primer; plasmids with the 16S rRNA gene sequence were analyzed with the CEQ 8000 genetic analysis system. Sequences with a minimum of 500 bp were used for phylogenetic analyses.

Phylogenetic analysis

The sequences were tested for chimeras by using the Ribosomal Database Project Chimera-Check program and aligned with ClustalW Phylogenetic analyses of partial 16S rRNA gene sequences conducted using the MEGA (molecular evolutionary genetics analysis) program, version 2.1. Neighbor-joining phylogenies were constructed from dissimilar distances and pair wise comparisons with the Jukes-Cantor distance model.

Statistical analysis and sequence population diversity

The approach of Humayoun et al. (2003) was followed for these analyses. One major assumption was that sequences with similarities of greater than 90% was be considered to represent the same phylotypes. Coverage (C) was calculated as follows: C = [1 - (n1/N)], where n1 is the number of phylotypes that occurred only once in the clone library and N is the total number of clones analyzed. Rarefaction curves were constructed using software available online at http://www.uga.edu/_strata/software.html. LIBSHUFF (version 1.2) analysis was performed to compute the homologous and heterologous coverage within and between clonal libraries (Singleton et al. 2001). Thus, the sampled diversity of a community can be directly compared to another community. The predicted coverage of a sampled library is denoted by the homologous coverage, and the heterologous coverage is the observance of a similar sequence in a separate library.

RESULTS

Two random samples of pooled isolated DNA from the 5 salamanders were analyzed. The average length of the initial amplified 16S rDNA product was 1,540 bp. Fifty-five clones were picked at random from each sample, and the average cloning efficiency was 94%. All sequences were compared to 16S rRNA gene sequences in GenBank between January and August 2007 using the BLAST program. Forty-nine operational taxonomic units (OTU) were found (Figure 1). Approximately 70% of the sequences obtained were between 90 and 95% identical to their closest relative in the database; about 20% of the sequences were between 96 and 97%. Each OTU represents a phylotype that may be

representative of a specific bacterial species. The Shannon-Wiener index for the bacterial population was 1.49. The Simpson's Index of Diversity was 0.983.

There were a total of twenty-three phylotypes related to gram-negative bacterial species. Fifteen (31%) of these sequences were similar to sequences found in the Cytophaga-Bacteriodes phylum. Five (10%) of the sequences were most closely related to those found in the Enterobacteriacae family. The remaining three gram-negative phylotypes most closely resembled *Thermosinus* (4%) and *Flavobacteria* (2%) genera.Two phylotypes were related to the class Mollicutes (2%) and to Verrucomicrobia.

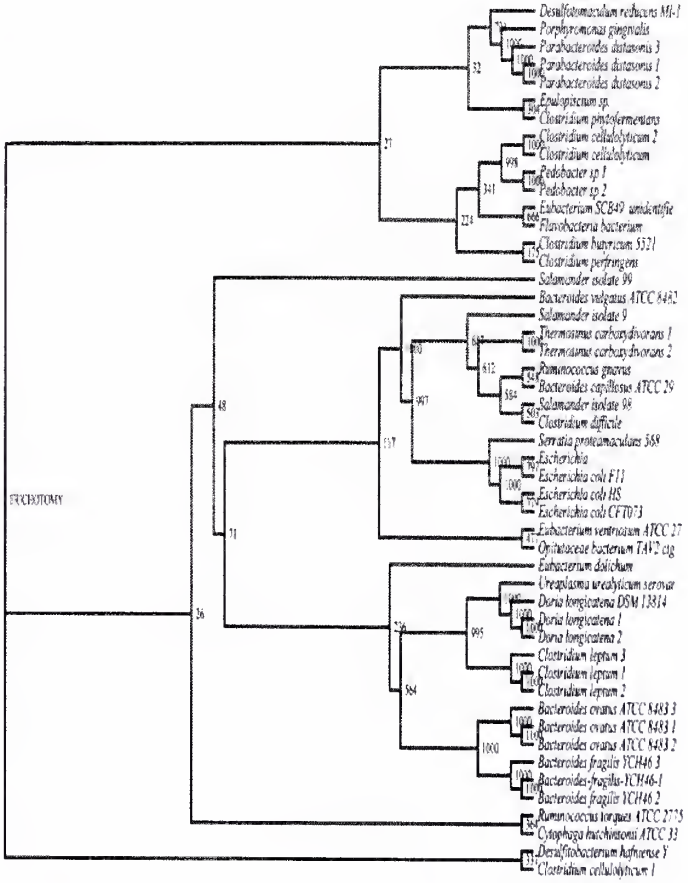

Figure 1 Dendrogram showing the phylogenetic affiliation of OTU's recovered from the intestinal tract of *Plethodon glutinosus*. 16S rDNA sequences of at least 500bp with a >90% similarity are shown and were aligned using the ClustalX alignment program.
Index numbers represent boot strap values.

(2%). Three salamander isolates comprising 6% of the total number of sequences recovered did not match any known sequence in the BLAST database. There were a total of twenty-one phylotypes related to gram-positive bacterial species. Thirteen (27%) of these sequences were related to the genus *Clostridium*. Six (12%) of sequences were most closely related to the genus *Eubacterium*, and two (4%) were similar to the genus *Ruminococcus*. A complete illustration of bacterial genera recovered is given in Figure 2.

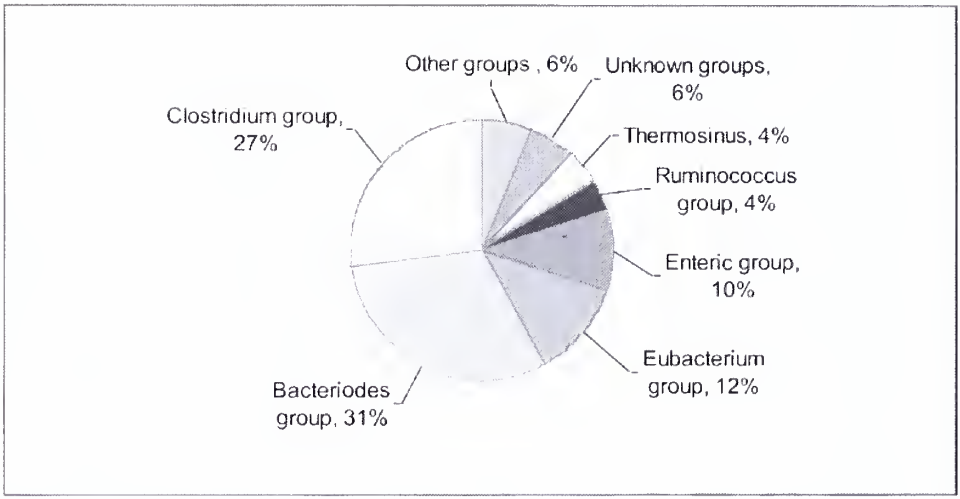

Figure 2 Percentage of total number of sequences recovered belonging to different phylogenetic groups. Sequences most closely related to those from the *Flavobacteria*, Opitutaceae, and *Ureaplasma* were classified as "Other groups." Those sequences that did not match any known sequences in GenBank were classified as "Unknown groups."

DISCUSSION

Unlike earlier research that has used conventional culture methodologies, this is the first clonal library-based assessment of microbial gut ecology among amphibians. Analysis of 16S rDNA clones recovered from the intestinal tract of *Plethodon glutinosus* revealed a diverse group of organisms. Fedewa (2006) has reported fluctuating gram-negative microflora during late metamorphosis in *Bufo terrestris* (Southern Toad) and *Pseudacris cruciferr* (Spring Peeper) using conventional culture. This fluctuation was suggested to be due to stress from development and habitat changes. Banas and Loesche (1988) characterized a significant decrease in the large intestinal bacterial diversity of hibernating versus non-hibernating *Rana pipiens*, also using conventional methodologies. Among the anaerobic bacteria recovered, *Clostridium, Bacteroides* and *Fusobacterium* species were predominant. Facultative strains included enterobacteria in non-hibernating frogs and *Pseudomonas* species in hibernators.

In this study, 74% of sequences recovered appeared to be closely related to the *Bacteroides*, *Clostridium*, *Eubacterium*, and *Ruminococcus* genera. Further, only 10% of the sequences recovered belonged to enteric bacteria such as *Escherichia* and *Serratia*. We suggest that predominant anaerobic populations may play a pivotal role in the production of short chain fatty acids that would contribute to the nutrition and survival of the salamanders. Pryor et al. (2005, 2006) has reported that fermentation processes occur in the large intestine of various reptiles and amphibians and that short chain fatty acids (SCFA) are produced. In one experiment looking at gastrointestinal fermentation of the Greater Siren (*Siren lacertina*), it was shown that acetate was a common SCFA produced (Pryor et al. 2006). In many herbivorous reptiles, digestive fermentation is carried out in the large intestine except with *Pseudemys nelsoni* (Red Bellied Cooter), where digestive fermentation occurs in both the large and small intestine (Bouchard and Bjorndal 2005). Microbiota and the presence of various gut symbionts are responsible for fermenting such material as plant tissue and insect exoskeletons and for producing the SCFA that are in turn used for energy by the animal.

One point of interest is the fact that no *Salmonella* spp. was recovered. According to Mitchell and Shane (2000), and Pasmans et al. (2003), some vertebrates, such as reptiles, harbor *Salmonella* within their gut and can transmit the bacteria through feces. In recent years, a multi-state *Salmonella* outbreak associated with Roma tomatoes was suggested to be associated with reptiles and amphibians (Corby et al. 2005). One possible explanation for the absence of *Salmonella* in *Plethodon glutinosus* could be the fact that this animal is strictly terrestrial, where *Salmonella* is not prominent.

Three salamander isolates did not match any known sequences in GenBank. We believe that these sequences could be novel phylotypes that have not been previously characterized elsewhere (Figure 1). The role of *Ureaplasma urealyticum* and the *Verrucomicrobium* is unknown. Four percent of the sequences examined were more closely related to the genus *Thermosinus,* which are thermophilic, gram negative soil inhabitants commonly found in or around hot springs (Sokolova et al. 2004). Since *P. glutinosus* spends the majority of its time under rotting logs or underground, emerging only at night or after brief downpours, we hypothesize that these organisms could represent transient intestinal colonization caused by ingesting fine soil particles.

The intestinal microbiota of amphibians, especially salamanders, represents an understudied area in the field of herpetology. This study may help bridge the gap in understanding between the bacteria residing in the gut and digestive fermentation. Future studies should address the numbers of specific bacterial species present and the roles they play in the animal's survival. Overall, the focus of the reported study was to provide an initial survey of the bacterial gut ecology of Plethodontae and, therefore, serve as a baseline for future comparisons.

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ENERGY ALLOCATION FOR EGG PRODUCTION DURING STARVATION IN SYMPATRIC CRAYFISH, *Procambarus clarkii* and *Procambarus zonangulus*

Mickie L. Powell and Stephen A. Watts

Department of Biology, UAB, 1300 University Blvd.
Birmingham, AL 35294-1170
Correspondence: mpowell@uab.edu

ABSTRACT

The range of *Procambrus clarkii* and *P. zonangulus* across North America varies in climate and nutrient availability. One speeies will usually dominate where their ranges overlap. We hypothesize that reproductive strategies may influence species success. We examined production and energy content of eggs extruded under *ad libitum* and starvation conditions for both species. Starvation did not affect the timing of egg extrusion, mean egg dry weight, or energy content in either species as compared to fed individuals. The mean energy content for *P. clarkii* eggs was significantly ($p<0.5$) lower than *P. zonangulus* eggs (0.010±0.004 vs 0.019±0.003 kilocalories/egg, respectively) regardless of nutritional status. However, *P. clarkii* extruded significantly ($P<0.05$) more eggs per clutch than *P. zonangulus* regardless of nutritional status. Starved *P. clarkii* extruded significantly more eggs compared to fed *P. clarkii* (433±24 vs 340±29, respectively). Mean egg wet weights were significantly ($p<0.05$) lower for starved *P. clarkii* eompared to fed (14.7±0.7 vs 9.5±0.2, respectively). These data suggest egg production in *P. clarkii* is affected by food availability, and may have the potential to affect species eomposition in culture ponds.

INTRODUCTION

Nutrient and energy availability directly influence the distribution and production of crayfish at various latitudes (Momot 1984). Although *P. clarkii* and *P. zonangulus* are able to survive and compete in a sympatric environment, each has adaptations specific to conditions in its historie range. For example, egg produetion and physical characteristics differ between these species. Based on the physieal charaeteristics of the eggs produced by these species, Noblitt (1995) hypothesized that the relatively large number of small eggs produced by *P. clarkii* a response to conditions of high food abundance and stable climate, whereas the relatively small number of large eggs produced by *P. zonangulus* were an adaptation to climates where nutrient flow is pulsed, energy input is low, and eonditions are not predictable. In the southeastern United States, the habitats for these crayfish can be highly dynamic, changing both seasonally and annually. Information on how environmental eonditions prior to and during reproduction affect fecundity is limited.

However, species composition in ponds has been observed to change over time.

Procambarus clarkii and *P. zonangulus* retreat to burrows in the late spring as water levels in ponds begin to fall (Huner and Barr 1991). The females extrude their eggs and remain in the burrow for up to five months as the eggs develop. Since forage is often depleted in the ponds prior to crayfish retreating to burrows, and since it has been suggested that crayfish may stay in the burrows for an extended time period, a period of presumed starvation coincides with egg development, maturation, and extrusion (Huner and Barr 1991). During these periods, any differences in the number and size of the eggs between these two species may represent differences in energy investment, which could ultimately influence the number and survival of offspring. Since eggs represent an energy investment during the time in the burrows, we examined the timing of egg extrusion and number of eggs extruded in *P. clarkii* and *P. zonangulus* when fed or starved and held in artificial burrows in the laboratory.

MATERIALS AND METHODS

Adult intermolt *Procambarus clarkii* and *P. zonangulus* (23.1±0.6 g wet weight) were obtained from the Louisiana State Aquaculture Research Facility, Louisiana State University, Baton Rouge, Louisiana in June of 1998. Crayfish were transported to the University of Alabama at Birmingham, placed individually in closed boxes (16 x cm x 11 cm x 4 cm, representing an artificial burrow), perforated with 1 cm holes on all sides, floating in one of eight independent recirculating raceways (0.6 m x 2.4 m x 0.5 m). Fresh water was passively circulated within each burrow to maintain water quality. Each raceway contained a biological filter, and solid waste was removed from the containers by siphoning every other day. Water was replaced as needed with dechlorinated tap water. Water quality was tested weekly for pH, ammonia, nitrite, and nitrate using colorimetric analysis (La Mott or Hach). Water temperatures and light were maintained at 20-22 C and 12 hr light/dark cycle, respectively, for all treatments.

Containers holding an individual crayfish were randomly assigned to one of eight raceways, and individuals were either fed (control) or starved for 5 months (n=70 females per species per treatment). There was no significant difference in the size (total length and wet weight) between the species or treatment groups. Fed controls received a formulated diet (Meade and Watts 1995) at a rate of 10% of their mean body weight once a day, and uneaten food was siphoned after 24 hours. Crayfish were checked daily for extruded eggs. Upon extrusion, eggs were removed from the pleopods by grasping the top of the pleopod with forceps and scraping the eggs from the pleopod. Once removed the eggs were then placed in vials. Eggs were blotted for 15 sec on a paper towel, and wet weight of the entire clutch was recorded. To determine dry matter content, all eggs were freeze-dried in a Lyph-Lock 12 freeze dryer (Labconco, Kansas City, MO) until dry weights remained stable (48 to 72 hr). Freeze-dried eggs were counted for each individual, and total energy was determined for 40 eggs from 10 randomly-selected individuals in each treatment. Energetic values were determined using a Parr Semi Microbomb Calorimeter

(Parr Instruments, Moline, IL), and individual egg energy was estimated by dividing total sample energy by the 40 eggs.

Statistics

Statistical analyses of all data were performed using the SAS System 9.1 for Windows (SAS Institute, Inc., Cary, NC, USA). Normality and homogeneity of variances were tested initially using Kolmogorov-Smirnov and Levene tests, respectively, and all data satisfied the assumptions for parametric analysis. Analysis of variance (ANOVA) and Tukey's post hoc test were performed to evaluate the effect of treatment on egg number, egg weight, and energy between species and treatments. Student's T-tests were performed to evaluate differences within species between treatments. Egg energy content over time was analyzed by regression analysis. For all analyses, a $P \leq 0.05$ was considered statistically significant.

RESULTS

Water quality remained within parameters acceptable for crustacean culture (pH 7.5, ammonia and nitrite < 0.5 ppm, nitrate < 10 ppm) for the five-month study.

Egg extrusion was first observed August 18, approximately 60 days after the beginning of the experiment, and continued for approximately 2 months. Starvation did not affect the timing of egg extrusion in *P. clarkii* (Figure 1). *Procambarus clarkii* extruded significantly ($P \leq 0.05$) more eggs per clutch than *P. zonangulus* regardless of the treatment (*P. clarkii* extruded a mean of 340±29 mean±SEM per individual or 433±24 mean±SEM per individual, and *P. zonangulus* extruded a mean of 229±20 or 244±25 mean±SEM per individual for fed or starved, respectively; Figure 2). There was no significant difference in the number of eggs extruded by fed and starved *P. zonangulus* (Figure 2). In contrast, starved *P. clarkii* extruded significantly more eggs (p=0.01) compared to fed *P. clarkii* (Figure 2).

Figure 1. Egg extrusion dates for starved (□, n=25) and fed (■, n=24) *P. clarkii* and starved (△, n=28) and fed (▲, n=29) *P. zonangulus*. Dates of egg extrusion represent the five months eggs were extruded while individuals were held in artificial burrows.

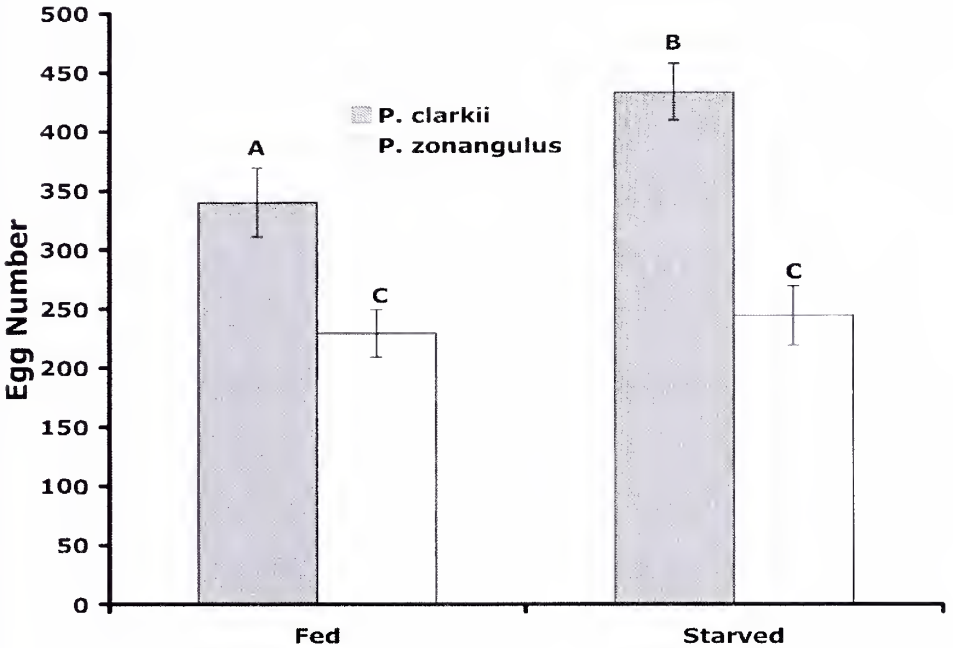

Figure 2. Mean number of eggs per clutch in fed (n=24)and starved (n=25) *P. clarkii* (shaded bars) and in fed (n=29) and starved (n=28) *P. zonangulus* (open bars). Error bars represent ± SEM. Different letters indicate significant difference (P≤0.05) within each species

Mean egg dry weight and energy content were not affected by starvation for either species; however, mean egg wet weights were signifieantly lower for starved *P. clarkii* compared to fed (Table 1). The mean energy content for *P. clarkii* eggs was approximately one-half the energy content of *P. zonangulus* eggs (0.010±0.004 vs 0.019±0.003 kilocalories/egg (P≤0.05), respectively (Table 1). Although *P. clarkii* eggs were smaller, total egg clutch energy was significantly higher (P≤0.05) for starved *P. clarkii* when compared to all other treatments due to the higher number of eggs extruded (Figure 3). Regression analysis indieated that energy content of individual eggs did not vary significantly over the extrusion time for either treatment or species.

Table 1. Mean individual egg wet and dry weights and energy (SEM) for fed (n=24)and starved (n=25) *P. clarkii* and in fed (n=29) and starved (n=28) fed and *P. zonangulus* (n=29 and 28, respectively). For each parameter, letters indicate significant difference between treatments within and between species.

	Wet Weight (mg)		Dry Weight (mg)		Energy (cal/egg)	
	Fed	Starved	Fed	Starved	Fed	Starved
P. clarkii	14.7(0.7)[a]	9.5(0.2)[b]	1.8(0.05)[a]	1.8(0.03)[a]	10.5(0.36)[a]	11.2(0.27)[a]
P. zonangulus	18.6(1.9)[c]	19.1(0.5)[c]	2.8(0.14)[b]	2.9(0.01)[b]	19.4(0.56)[b]	18.1(0.76)[b]

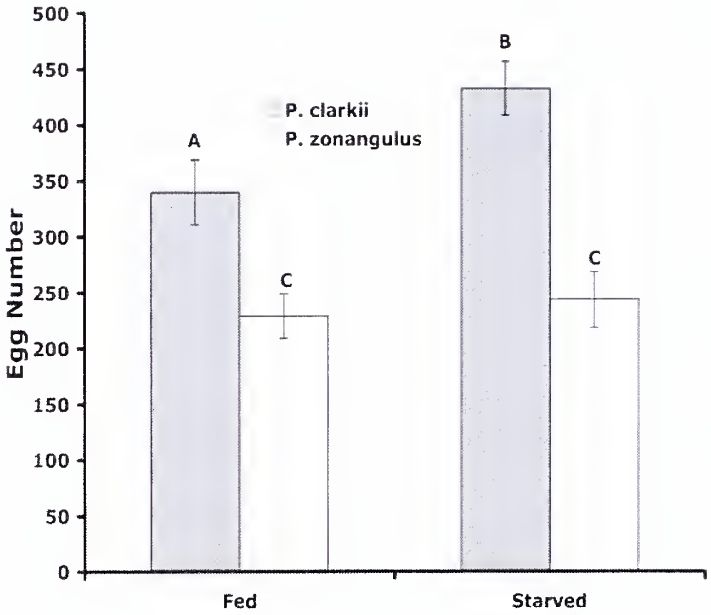

Figure 3. Total energy of extruded egg clutch in fed (n=24) and starved (n=25) *P. clarkii* (shaded bars) and in fed (n=29) and starved (n=28) *P. zonangulus* (open bars). Error bars represent ± SEM. Different letters indicate significant difference (P≤0.05) within each species.

DISCUSSION

The crayfish used in this study represented a population exposed to natural environmental conditions prior to the initiation of these experiments. The experiments were designed to correspond with the natural reproductive cycle of these species in commercial culture ponds in the southeastern United States. Hence, the physiological condition and reproductive state of crayfish in this study was representative of the natural pond population as they retreated into burrows and prepared to extrude eggs.

Previous studies have shown that crayfish size, age, and pond management strategy can all affect egg number and size (Huner and Lindqvist 1991) in commercial culture. However, limited data are available on egg production by crayfish in burrows. Several studies have examined ovarian egg production, but this is only a measure of potential fecundity, as all eggs produced may not be extruded (Huner and Lindqvist 1991). Extruded eggs represent a considerable energy investment for females, particularly when food availability is limited, while eggs retained in the ovaries still have the potential to be resorbed and utilized as an energy source.

The size and number of eggs produced have been correlated to the characteristics of the life history strategy of particular crayfish (Huner and Lindqvist 1991). R-selected crayfish species are short-lived, grow rapidly, and generally produce large numbers of small eggs. *Procambarus clarkii* is often classified as an R-selected crayfish (Huner and Lindqvist 1991). Under the low-nutrient conditions of the present study, female *P. clarkii* increased the number of eggs extruded, representing an increased energy investment in reproduction. The short lifespan of *P. clarkii* limits the number of reproductive seasons; thus, extruding large numbers of eggs is an effective mechanism to insure species success. In contrast, K-selected speeies in general are long-lived, grow slowly, and produce a smaller number of larger eggs. *Procambarus zonangulus* has characteristics consistent with a K-selected species (Huner 2002). Mason (1979) found no benefit of egg size on egg viability in *Pacifasticus leniusculus*. However, larger eggs generally produce larger hatchlings, which may increase their chances of surviving predation in a pond environment (Colinvaux 1986). *Procambarus zonangulus* hatchlings are about 1-2 mm larger than *P. clarkii* hatchlings, potentially providing a competitive advantage over *P. clarkii* if hatchlings emerge at the same time (Huner 2002).

Temporary changes in environmental factors can influence phenotypic traits that are under the control of evolutionary factors (Mashiko 1990). In the freshwater prawn *Macrobrachium niponese,* hydrogeographic features of the habitat are an important factor in the size and number of eggs produced (Mishiko 1990). In the commercial culture of crustaceans, conditions usually differ from the natural environment; consequently, egg production differs from that observed in natural populations. Commercial culture of the crayfish *Orconectes virilis* results in the production of a greater number of smaller eggs and reduced variability in clutch size compared to that observed in the natural environments (Huner and Lindqvist 1991). Poor nutrition in *Cherax tenuimanus* culture ponds resulted in the production of smaller and less numerous eggs; however, females cultured in systems

with a composted detritus base supplemented with feed were the most productive (Morrisy 1975). In the current study, starvation resulted in an increase in clutch size for *P. clarkii*, suggesting that nutrition (food availability) affects reproductive output in *P. clarkii*, but not *P. zonangulus*. However, in a dynamic environment such as a commercial culture pond, where numerous biotic and abiotic conditions merge, there may be additional factors, singular or combinatorial, affecting egg production in these two species.

Nutrient availability in ponds and the natural environment cannot be precisely controlled. Starvation may occur at any time during the growing season, often in response to indirect consequences of unseasonable temperatures or rainfall amounts. The impact of starvation on egg production may vary depending on the time during the reproductive cycle when females experience starvation. If starvation or nutrient limitation occurs during the development of the eggs, resources may be differentially allocated to somatic tissues, resulting in fewer (or more) eggs being produced. If nutrients are limited after eggs have formed, egg production may be unaffected or eggs may be resorbed to provided essential energy and nutrients for somatic tissues. Resorption of oocytes in *O. virilius* populations has been correlated with nutrient deficient environments (Momot and Gowing 1977). We can conclude that egg production in *P.* is affected by food availability, and may have the potential to affect species composition in culture ponds.

ACKNOWLEDGEMENTS

We would like to thank Dr. Robert Romaire and Vernon Pfinster (Louisiana State University Aquaculture Center) for assistance in obtaining the crayfish for this study. This project was funded by the Tennessee Valley Authority.

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AGENDA
ALABAMA ACADEMY OF SCIENCE
FALL 2010 EXECUTIVE COMMITTEE MEETING
SAMFORD UNIVERSITY

SATURDAY, October 23, 2010, 7:30 AM; Room 033, William Self Propst Hall

A. Call to order and approval of minutes of the Spring 2010 Executive Committee Meeting (See JAAS, April 2010 issue)

B. Officers Reports.....3

1. Board of Trustees — Ken Marion
2. President — Brian Burnes
3. President -Elect — Mickie Powell
4. Second Vice President — Ronald Hunsinger
5. Secretary — Jim Rayburn
6. Treasurer — Bettina Riley
7. Journal Editor — Safaa Al-Hamdani
8. Counselor to AJAS — Henry Barwood
9. Science Fair Coordinator — Virginia Valardi
10. Science Olympiad Coordinator — Jane Nall
11. Counselor to AAAS — Steve Watts
12. Section Officers
    - I. Biological Sciences — Megan Gibbons
    - II. Chemistry — Emanuel Waddell
    - III. Physics & Mathematics — Nirmol Podder
    - IV. Engineering & Computer Science — David Thornton
    - V. Social Sciences — Richard Hudiburg
    - VI. Anthropology — Harry Holstein
    - VII. Science Education — Janet Gaston
    - VIII. Industry, Environmental, and Earth Science — Yong Wang
    - IX. Health Sciences — John Martin
    - X. Bioethics & History/Philosophy of Science — Gerry Elfstrom
13. Executive Officer — Larry Krannich

C. Committee Reports.....19

1. Local Arrangements — George Cline, James Rayburn
2. Finance — Ken Marion
3. Membership — Vacant
4. Research — George Cline
5. Long-Range Planning — Adrian Ludwick
6. Auditing, Senior Academy — Robert Angus
7. Auditing, Junior Academy — Henry Barwood

8. Editorial Board & Associate Journal Editors — Thane Wibbels
9. Place and Date of Meeting — Vacant
10. Public Relations — Roland Dute
11. Archives — Troy Best
12. Science and Public Policy — Scott Brande
13. Gardner Award and AAS Fellows — Prakash Sharma
14. Carmichael Award — Richard Hudiburg
15. Resolutions — Vacant
16. Nominating Committee — Ron Hunsinger
17. Mason Scholarship — Mike Moeller
18. Gorgas Scholarship Program — Ellen Buckner
19. Electronic Media — Brian Toone

D. Old Business 31
E. New Business 31
F. Adjournment.....31

The officer and committee reports were reviewed and some discussion occurred relative to particular reports:

President's Report:

Safaa agreed to draft a letter concerning the Journal and forward this to Brian for incorporation into a general letter for distribution to all science department chairs in Alabama. Promotional material on the Journal will be included with this distribution.

The Executive Committee approved the design of a poster to advertise the Journal and a budget of $600 to print and distribute the poster.

The Executive Committee approved converting all the JAAS issues into PDF format with each article being a separate PDF file for indexing purposes in Medline/PubMed.

Vice-President Report: The Chairs of the Membership, Date and Place of Meeting, and Resolutions committees will be sought and suggestions were offered. Seeking a student to serve as Membership Chair will be explored.

Secretary report: Janie Gregg was nominated as Secretary and the Executive committee voted and approved her as the Secretary of the Academy.

Long Range Planning Report: The Executive Committee approved the recommended membership dues increases. The secretary was asked to send dues reminders this fall and encourage individuals to pay multiple year dues at the current rate. The new dues rates will go into effect on January 1, 2011.

All listed action items were discussed and approved (See Action Items).

As New Business, the minutes of this Fall 2010 Executive Committee meeting were approved for publication in the Journal.

The meeting was adjourned at 11:10 am

1. Call to Order

2. Review/approval of minutes of the Spring 2010 Executive Committee Meeting

ALABAMA A&M UNIVERSITY
TUESDAY, March 30, 2010, 7:15 PM, KNIGHT CENTER

See April 2010 Issue of the Journal of the Alabama Academy of Science

B. Officer Reports

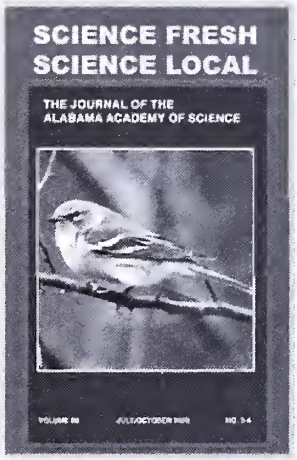
B-1

Board of Trustees Report

No report submitted.

B-2

President's Report



1. I am working on a letter we agreed to send to the Science Department Head who rejected the Journal of the Alabama Academy of Science and demeaned the quality of the journal to his faculty. Rather than directly address this situation, the particulars of which are unknown to me, I suggest a general letter to the scientific community (including the Department Head) promoting the peer-reviewed, professional quality of the JAAS.
2. We need to decide how to market the JAAS. Should we use a distribution List (add AAS membership?); create a poster/pamphlet, i.e.
3. What is the feasibility of indexing the JAAS in Medline/PubMed? There is an instruction page at http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=helppubmed&part=publisherhelp#publisherhelp.Data_Provider_Quick_. Basically, we need to supply and submit XML tagged citations and abstracts that can be linked to pdf files which will be kept on the AAS server. Pambanisha King, Document Delivery Head, Auburn University will send the JAAS in batches to UWA for scanning into .pdf files.

Respectively submitted
Brian Burns, President

B-3

Report of the President-Elect

In the next year I will be contacting the Secretary to become more familiar with his duties as stated in the constitution. I also plan on meeting with the Counselors of the Junior Academy and the State Coordinator of the Regional Science Fairs and the State Coordinator of the Regional Science Olympiads to discuss how the academy can assist with the coordination of their events.

We currently have two committee slots vacant Membership and Place and Date of Meeting. I have contacted Dr. Mark Meade (JSU) to see if he would consider continuing to serve on these committees and to suggest a possible nominee if he is unable to serve.

During my tenure as President-Elect I look forward to working with all of the Executive Committee to prepare for my duties as President.
Respectfully submitted
Mickie L. Powell
President-Elect

B-4

Second Vice President Report

As of the last executive committee meeting the following positions have been filled:

Second Vice-Chair
Ronald Hunsinger (Samford University) has accepted the nomination for second vice-chair.
Treasurer
Bettina Riley (UAB) has accepted the nomination for treasurer.
Associate Counselor to the Junior Academy
Catherine Shields (Jefferson County International Baccalaureate) has agreed to fill the vacant position of associate counselor to the Junior Academy.

Since the last executive committee meeting, Marietta Cameron, has declined the nomination for Secretary. Janie Gregg (UWA) has agreed to be the nominee for Secretary and action on this nomination will occur at the Fall Executive Committee meeting.
We currently have two committee slots vacant Membership and Place and Date of Meeting. I have contacted Mark Meade to see if he would consider continuing to serve on these committees and to suggest a possible nominee if he is unable to serve.
Respectfully submitted
Ronald Hunsinger
Second Vice-President
Action Item:
Approve Janie Gregg as the Secretary of the Academy.

B-5

Secretary Report

See the April 2010 issue of the Journal of the Alabama Academy of Science for the minutes from the Spring 2010 Executive Committee Meeting and the Annual Meeting of the Academy.
Due to family matters and other personal issues I have not been able to update the membership list or send out reminders. Marietta Cameron was unable to take over the secretary position due to personal reasons. Janie Gregg has agreed to be nominated for the position of secretary and the Executive Committee will vote on this at the executive meeting. I will have information and checks to pass on to the new secretary and will be available for questions about the position.
Respectfully submitted,
James Rayburn, Past Secretary.

Treasurer's Report

The treasurer's report consists of the following:

Balance Sheet as of October 1, 2010 is shown below:

Respectfully submitted,
Bettina H. Riley
Treasurer

Alabama Academy of Science
Balance Sheet as of 10/01/2010

Account	Balance
ASSETS	
Bank accounts	
CD (1) + CD (2)	$17,875.01
Savings/checking account	1,264.36
Checking	6,604.20
Accounts Receivable	
Science Fair	
Memberships	
Subscriptions	50.00
TOTAL ASSETS	**$25,793.57**
LIABILITIES	
Accounts Payable	
Journal Expenses	$2,924.27
Travel Awards	225.00
Honorarium	500.00
TOTAL LIABILITIES	**$3,649.27**
NET WORTH	**$22,144.30**

Journal Editor Report

The following has been accomplished since the last meeting:

- The Alabama Academy of Science Journal Vol. 81. No 1&2 has been successfully released.
- We are on time in releasing the October issue of the journal for 2010. I am planning to send all the articles to the publisher by the end of October.
- I would like to bring to the attention to the members of the academy to become more active in submitting papers to the journal and volunteering to review manuscripts.

- I have met with Stephen Wallace, the Exeeutive Sales Representative for Cengage Learning - Brooks/Cole Pub. and he informed me that they are willing to continue to advertise in the journal.

Respectfully submitted,
Safaa Al-Hamdani, Editor

B-8

Counselor to Alabama Junior Academy of Science Report

No report submitted.

B-9

Science Fair Coordinator Report

No report submitted.

B-10

Alabama Science Olympiad Report

Registration for participation in Science Olympiad is in progress and going well. Most of the hosts have set dates; but we need a host for State C, the high school level. Kindly, consider showcasing your campus by hosting the Division C tournament.
Scheduled are three elementary tournaments at University of West Alabama, Jacksonville High School and Auburn University. Four regional middle schools tournaments will take place on Auburn University, Spring Hill College, University of Alabama Huntsville and University of Alabama Tuscaloosa. State tournament will be hosted by Huntingdon College. The high school division regional tournaments are scheduled to be hosted by Spring Hill College, University of Alabama Birmingham (first year to host), University of Alabama Huntsville and the University of Alabama Tuscaloosa. I am in desperate need of a host for State C. It will involve twelve to 15 teams at most. Please contact me for information.

Jane Nall
Spanish Fort High School
1 Plaza deToros
Spanish Fort, AL 36527
jdnall@bcbe.org
drnall@hotmail.com

I have two seniors students who have a project that I would like to enter into Gorgas and Alabama Junior Academy. If a team project is permitted, kindly send me the paperwork.
Respectively submitted
Jane Nall
State Coordinator

Counselor to AAAS Report

The annual meeting for the AAAS affiliates will convene on February 17-21, 2011 in Washington DC. The theme will be *Science without Borders*.

The 2011 meeting's theme—Science Without Borders—integrates the practice of science, both in research and teaching, that uses multidiseiplinary approaches to problem solving, crosses conventional borders, and takes into consideration the diversity of investigators and students. The program will feature sessions with strong seientific content across many science and engineering fields.

The Annual Meeting of the American Association for the Advancement of Science (AAAS) is the most important general seience venue for a growing segment of scientists and engineers who are interested in the latest advances as well as multidisciplinary topics and the influence of seienee and technology on how we live today. Thousands of leading seientists, engineers, educators, and policy-makers interact with one another and with hundreds of members from national and international media. In fact, the growing number of international attendees attests to the growing international nature of this gathering. More than 150 sessions spread across about a dozen traeks are usually presented at the Annual Meeting.

Please check out the website at www.AAAS.org. It contains up-to-date information on science and education news.

We welcome the opportunity for any AAS member to attend the AAAS meeting on our behalf. Information about the AAAS can be obtained at www.aaasmeeting.org.
Respectively submitted,
Stephen A. Watts,
Counselor to AAAS

B. 12. Section Officers

B-12, 1

Biological Sciences Section Report

The final numbers for the 2010 AAS meeting at Alabama A&M University were:
A total of 79 presentations were made by faculty and students.

35 talks (37 entered, 2 no shows)

44 posters (we do not have a record of the no-shows)

Sixteen students were entered in the competition for best talk. Because we had more than 12 students in the paper competition we gave two awards:

Andrew T. Coleman, UAB, Examining evolutionary and conservation implications of maternal influence on egg size and hatehling fitness in the Mississippi diamondback terrapin (*Malaclemys terrapin pileata*).

and

Jonathan P. Huang. UAB, Study of the microbial diversity in a newly discovered East Antaretie freshwater lake L27C using both culture-independent and culture-dependent methodologies.

Thirty-one students were entered in the competition for best poster. Because we had more than 12 students in the poster competition we gave two awards.

David Asiamah, Alabama A&M University, Chemopreventive effects of bitter melon.

and

Omowunmi A. Owoseni, Auburn University, The involvement of SCL3 in salt tolerance in *Arabidopsis thaliana*.

The talks and poster sessions were well attended, but combining AAS with Gorgas competition posters made it very difficult to find, judge, and keep track of posters in the AAS competition. I suggest facilitating the process in 2011 by grouping all AAS competition posters together.

After the spring meeting, Dr. Ketia L. Shumaker will take over as chair of the Biologieal Sciences section, and Dr. Malia Fincher (or Samford) will take over the position of vice-chair for the Biological Sciences section

Respectively submitted,

Megan Gibbons, Section Chair

B-12, II

Chemistry Section Report

No report submitted.

B-12, III

Physics and Mathematics Section Report

No report submitted.

B-12, IV

Engineering and Computer Science Section Report

At the Section's Business Meeting in the Spring, the Section elected Qichao Liu as Vice-chair. He will become Chair in 2012.

Respectfully submitted,

David Thornton, Section Chair

B-12, V

Social Sciences Section Report

This is the initial report of Section V of the AAS that was approved in 2010. The old Section VIII –Behavioral and Social Seiences had 7 papers and 3 poster for the 87th annual meeting of the Alabama Academy of Science. There was increased participation in the student competition for this section.

The section chair and vice-chair will make an effort to contact academic departments at colleges and universities in Alabama in order to encourage participation in the 88th annual meeting at Jacksonville State University.

Respectfully submitted,

Richard A. Hudiburg, Section V Chair

B-12, VI

Anthropology Section Report

No report submitted.

B-12, VII

Science Education Section Report

No report submitted.

B-12, VIII

Industry, Environmental, and Earth Science Section Report

No report submitted.

B-12, IX

Health Sciences Section Report

No report submitted.

B-12, X

Bioethics & History/Philosophy of Science Section Report

The Section held its paper presentation session on Thursday, April 01, 1:00 p.m. to 5:00 p.m. in the Engineering Building Room 101 of Alabama A & M University in Normal, AL.

At the session, 6 papers were presented. They were:

Chimps in research: an historical perspective and evolving ethic. *Lewis Barker*, Auburn University.

Ethics in an age of genetic engineering. *Jennifer A. Trobaugh*, Auburn University.

Genethics: a course on 21st c biotechnologies and ethics. *James T Bradley*, Auburn Univeristy.

Science 2.0: blogs and the future of science publishing. *Michelle Sidler*, Auburn University.

The end of science. *Gerard Elfstrom*, Auburn University.

The human odyssey at auburn university-an interdisplinary curriculum in the sciences and humanities. *Mary T Mendonca*, Lewis Barker, Martha Escobar, and Roy Knight , Auburn University.

There were no poster submissions. One student entered the paper competition and received a reward.

At the Business meeting, Lewis Barker, Professor of Psychology at Auburn, was elected Vice-Chair.

Respectfully Submitted,
Gerard Elfstrom, Section Chair
Auburn University

B-13

Executive Director Report

Since March, 2010, I have been involved in the following activities as the Executive Director of the Alabama Academy of Science:

1. Distributed the Local Arrangements Manual to the local arrangements

committee at the Jacksonville University to assist them concerning arrangements, program booklet needs, and deadlines associated with the annual meeting of the Academy to be held on the JSU campus, March 2-4, 2010 with the Executive Committee meeting on March 2nd.

2. Prepared letters for distribution in late October to Alabama colleges and universities to solicit financial support for the Journal.
3. Prepared the Call for Papers for the 88th meeting of the Academy that will be distributed to all Section Chairs in hard and electronic copy after November 15th.
4. Updated the fliers and letters being sent to all Alabama chemistry faculty to solicit the participation of undergraduates and Alabama college and university Chemistry faculty in the 6th annual Undergraduate Chemistry Research symposium to be held in conjunction with the annual meeting of the Academy.
5. Contacted local sections of the American Chemical Society in the State to assess their willingness to again co-sponsor the state-wide undergraduate chemistry research symposium with the Academy.
6. Consulted with Brian Toone, Editor for Electronic Media, to re-activate the on-line submission of Executive Committee reports and generate a compiled document for distribution to all attendees at the meeting.
7. Developed a doodle.com site for intended participation in the Executive Committee breakfast and meeting.
8. Prepared the committee chair report compilation and action items for distribution at the Fall Executive Committee meeting.

Respectfully submitted,
Larry K. Krannich, Executive Director

C. Committee Reports

C-1

Local Arrangements Committee Report

We are proceeding along with the Local Arrangements for the 88th Annual Meeting of the Alabama Academy of Science in Jacksonville, AL.

Executive Committee Meeting

The Executive Committee Meeting will be Wednesday March 2nd. We will meet in the lobby of Martin Hall before proceeding to the President's Dining Room where we will eat and have the committee meeting.

Program

Senior Academy

We will begin the program sessions Thursday morning, 3 March, in Martin Hall. We have secured enough rooms that we can host all of the Senior Academy sessions in Martin Hall. All of the rooms will have computers and projectors for the presentations. There will be a room reserved on the second floor for reviewing slides.

While I don't anticipate any problems, I would recommend that presenters bring their

presentation on both a flash drive and a backup CD. PowerPoint presentations should be made in PowerPoint 2003 format.

Posters

Posters will be in the main hallway on the first floor of Martin Hall. At present, there will be no change in poster sizes/requirements.

Symposium

Dr. Frank Romano is organizing speakers for the Symposium (Friday AM) which will feature issues surrounding the Deep Horizon Oil Spill and current research efforts.

Junior Academy

The Junior Academy will meet in rooms on the 11th floor of the Houston Cole Library, beginning on Thursday 3 March. Winners of each section will then compete in a Final Competition Friday AM.

Gorgas Scholarship Competition

We are still working on accommodating the room requirements for the Gorgas Competition. Depending on how things work out, the Gorgas competition will be either held in McGee Hall or Houston Cole Library. We will have a room set up for Gorgas Posters on the 11th Floor of the Library adjacent to where lunch will be served.

Meals

Boxed Lunches – boxed lunched will be part of the meeting registration. Boxed lunches will include a sandwich, salad of the day, chips, fresh fruit, cookies, condiments, and choice of bottled water or soda

Lunches will be served on the 11th floor of the Houston Cole Library adjacent to the room with the Gorgas Posters (Friday)

Break Snacks – we are planning to have snacks during breaks in the morning and afternoon sessions both days. We are currently seeking sponsors for these breaks.

Banquet – Thursday Night

6:30 Pre-banquet Entertainment - JSU Steel Drum Band

7:00 PM - $22.00 buffet style –

Speaker – Hardy Jackson

Local dining

The committee will prepare a list of local restaurants for those that do not wish to order boxed lunches.

Registration

We have not yet settled on a price for Registration. Current estimates should keep the registration costs similar to recent years.

Hotels

Hampton Inn, 400 Spring Ave. NW, Jacksonville, (256)7820330

We're working on special rates

University Inn, 1530 Pelham Road South, Jacksonville (256)435-3300

Special rates: single King $42.00 + tax; double bed room $46.00 + tax

Respectfully submitted

George Cline

Mark Meade

James Rayburn

C-2

Finance Committee Report

The assets of the Academy as reported at the Fall Executive Committee meetings and Annual Spring meetings since 2001 are listed below.

Period	Assets (End of Period)	Change	Period	Assets (End of Period)	Change
1/1 – 10/12/2001	$71,763		1/1 – 12/31/2001	$75,813	
1/1 – 10/12/2002	$72,197	$434	1/1 – 12/31/2002	$72,813	–$3,000
1/1 – 10/12/2003	$71,403	–$794	1/1 – 12/31/2003	$74,800	$1,987
1/1 – 10/26/2004	$74,265	$2,862	1/1 – 12/31/2004	$74,610*	–$ 190
1/1 – 10/26/2005	$63,895	–$10,370	1/1 – 12/31/2005	$65,561*	–$9,049
1/1 – 10/26/2006	$62,162	–$1,733	1/1 – 12/31/2006	$67,555*	$1,994
1/1 – 10/31/2007	$34,004	–$28,158	1/1 – 12/31/2007	$36,435*	–$31,120
1/1 – 10/10/2008	$25,618	–$8,386	1/1 ––3/13/2009	$28,989*	–$7,44
1/1 – 10/14/2009	$26,937	$1,319	1/1 – 3/23/2010	$26,814*	–$ 2,175
1/1 – 10/1/2010	$22,144	–$4,793			

Despite some recent stability, our assets have now reached a decade low. The Academy needs to maintain realistic budgets to reflect this and should consider steps (i.e., dues increase, increased meeting registration fees, etc.) to augment revenue in the near future.
Ken Marion
Chair, Finance Committee
*estimated

C-3

Membership Committee Report

No report submitted.

C-4

Committee on Research Report

This committee has not met since disbursing Travel Awards & Research Awards in Spring 2010. We will be discussing formalizing the process of disbursing awards and resolving problems with getting Research Grant funds to the students.
Respectfully submitted,
George Cline, Chair
Committee on Research

C-5

Long-Range Planning Committee

The committee presents the following two suggestions for discussion.

1. A modest increase in dues, as follows:
   - full member - 1 year, from $30 to $40; 2 years, from $55 to $70; 3 years, from $80 to $100
   - student member - from $15/year to $20/year

2. Utilization of Facebook as a tool to attract members and to communicate about AAS.

Respectively submitted,
Adriane Ludwick, Chair

Action Items

Increase in membership dues for 2011

C-6

Auditing, Senior Academy Committee Report

I have contacted the Secretary, Bettina Riley. In January, 2011 Ms. Riley will make the Academy's 2010 financial records available to me. I will carefully review the records and will submit an auditor's report before the spring meeting.

Respectfully submitted,
Robert Angus, Chair
AAS Auditing Committee

C-7

Auditing, Junior Academy Committee Report

No report submitted.

C-8

Editorial Board & Associate Journal Editors Committee Report

No report submitted.

C-9

Place and Date of Meeting Committee Report

No report submitted.

C-10

Committee on Public Relations Report

There is nothing to report.
Respectfully submitted,
Roland Dute, Chair

C-11

Archives Committee Report

We need to obtain photographs (especially of members of the Executive Committee), committee reports, minutes of the AAS Executive Committee meetings, and any other materials that may be of interest to our membership. Items that may not seem of interest at present may be of great interest in the future. Photographs of officers and members at meetings are of special interest.

If you have items that you believe may be worthy of inclusion in the AAS Archives, please send them to me or to Dr. Dwayne D. Cox, University Archivist, Auburn University Ralph B. Draughon Library, 231 Mell Street, Auburn University, AL 36849.

Access to our AAS Archives is available 7:45-4:45 Monday-Friday. Dr. Cox has provided the following information relative to access. Archives materials **do not** go out on interlibrary loan. Patrons can come in and use them according to the donor specifications. Some require special permission from the donating office or persons who made the donation or sometimes the archivist. Materials to be used at night or weekends need to have special arrangements made so they can be pulled before 4:30 in the afternoon (Friday afternoon for weekend use). Copies can be made in most cases and that can be done either by going through InfoQuest or contacting Dr. Cox or the reference desk at 334/844-1732.

I encourage all officers and members of the AAS to donate significant documents, photographs, etc. to the archives.

Respectfully submitted,

Troy L. Best

Archivist, Alabama Academy of Science

C-12

Committee on Science and Public Policy Report

No report submitted.

C-13

Gardner Award & Fellows Committee Report

The **Wright Gardner Award** was established by the Alabama Academy of Science in 1984 to honor individuals whose work during residence in Alabama had been outstanding. Persons nominated for this award have included researchers, teachers, industrialists, clinicians, scholars and active members and office bearers of the Alabama Academy of Science.

This is to request each and every member of this academy to publicize to individuals, heads of departments, deans and provosts of colleges and universities about this prestigious award. Please solicit nominations from individuals and different academic and industrial organizations for this award.

The **Fellow of the Alabama Academy of Science** designation is made by the Alabama

Academy of Science to recognize individuals for their contributions in science in the State of Alabama and for their service to the Academy. AAS members are invited to submit nominations for this award to the chair of the committee not later than January 10, 2011. Members of the committee should encourage AAS members to submit nominations of outstanding persons. Each nomination should consist of a curriculum vitae and documentation substantiating the person's special contribution to science in Alabama and service to the Academy.

Nominations for the **Wright Gardner Award** and **Fellows of the Alabama Academy of Science** should be forwarded to:

Dr. P. C. Sharma, Chair, Wright Gardner & Fellow Award Committee,
Head of Physics Department
Tuskegee University
Tuskegee, AL 36088.
Phone: (334) 727-8998; Fax: (334) 724-3917
e-mail: pcsharma@tuskegee.edu

The nominations should consist of the following documents.

(i) Formal Nomination Letter,
(ii) Vitae and at least three letters of references from peers, administrators and one by an expert in the area of his/her research, and
(iii) One page citation that will be used for presentation of the award.

Anything missing from items (i, ii, iii) will result in rejection of the nomination.

The closing date for nominations is January 10, 2011. The award will be presented in the "Annual Meeting of Alabama Academy of Science-Banquet", on Thursday, March 3, 2011.

Respectively submitted,
Dr. P. C. Sharma, Chair

C-14

Carmichael Award Committee Report

The committee looks forward to reviewing research articles published in Volume 81 of the *Journal of the Alabama Academy of Science* in 2010. The Emmett B. Carmichael Award will be announced during the 88th annual meeting in March 2011.

Respectfully submitted,
Richard A. Hudiburg
Chair, Emmett B. Carmichael Award Committee

C-15

Resolutions Committee Report

No report submitted.

C-16

Nominating Committee Report

See Second Vice President's Report, B-4

William H. Mason Scholarship Committee Report

Last spring the Committee reviewed two completed applications for the William H. Mason Scholarship. After assessing all application materials the Scholarship Committee offered the $1000 scholarship to Ms. Danielle Morlan. Ms. Morlan accepted the award and is enrolled in the non-traditional/5th year teaching master's program at the University of West Alabama.

The previous recipients of the William H. Mason Scholarship are:

1990 - 1991	Amy Livengood Sumner
1991 - 1992	Leella Shook Holt
1992 - 1993	Joni Justice Shankles
1993 - 1994	Jeffrey Baumbach
1994 - 1995	(Not awarded)
1995 - 1996	Laura W. Cochran
1996 - 1997	Tina Anne Beams
1997 - 1998	Carole Collins Clegg
1998 - 1999	Cynthia Ann Phillips
1999 - 2000	Ruth Borden
2000 - 2001	Karen Celestine, Amy Murphy
2001 - 2002	Jeannine Ott
2002 - 2003	(Not awarded)
2003 - 2004	Kanessa Miller
2004 - 2005	(Not awarded)
2005 - 2006	Mary Busbee, Bethany Knox
2006 - 2007	Kelly Harbin
2007 - 2008	Michael Hallman
2008 – 2009	Sheri Sanders Grosso
2009 – 2010	(Not awarded)
2010 – 2011	Danielle Morlan

Attached to this report is a copy of an announcement that the Committee again plans to be sending soon to deans in colleges of science and colleges of education within Alabama. Members of the AAS Executive Committee are encouraged to copy and disseminate this information.

Respectfully submitted,
Michael B. Moeller, Chair
William H. Mason Scholarship Committee

C-18

Gorgas Scholarship Committee Report

2010 Gorgas Scholarship Competition: The final competition of the Alabama Science Scholar Search and Gorgas Scholarship Program was held at the Alabama A & M University, Normal, Alabama, on April 1, 2010. The press release of the winners is

attached. The Gorgas Scholarship Committee would like to recognize the outstanding teacher-sponsors of these students. Their work in encouraging students to enter the competition is instrumental to both the success of the program and to the success of the students. The 2011 Flyer is attached.

Ruth Borden, Alabama School of Fine Arts	Dasi Mosley Ramsay High School
Lady Emrich Grissom High School	Catherine Shields Jefferson County International Baccalaureate
Vicki Farina Brooks High School	Emily Stafford Deshler High School
Julibeth Jones Jefferson County International Baccalaureate	Virginia Vilardi Wetumpka High School
Barry McPhail Alabama School of Math and Science	Nabiha Yuouf Ramsay High School

The winner of the **2010 Outstanding Teacher was Ms. Wanda Phillips, Brooks** High School in Killen, Alabama. Ms. Phillips continues to encourage these outstanding students even in retirement and the science program at Brooks HS is perennially one of the best in the state in producing these science scholars.

Gorgas-AJAS Teacher Fellow: The Gorgas Scholarship Committee is pleased to announce the appointment of Dr. Mark Jones as the 2010-2011 Gorgas-AJAS Teacher Fellow. A Press Release detailing Dr. Jones' qualifications is included in this report.

Additional Scholarships to Alabama Universities: Due to efforts by committee member Betsy Dobbins, Samford University will join the list of state institutions awarding additional scholarships to finalists and winners. Thanks to all those who were instrumental in obtaining this commitment.

Gorgas Committee 2010: Thanks to the Gorgas Committee who worked through conference calls and at the AAS meeting to develop the Teacher-Fellow program, review candidates and provide follow-up and resources for the program.

Dr. Larry Krannich	Co-Chairman, Chemistry, UAB, Executive Director, AAS
Dr. Betsy Dobbins	Biology, Samford University
Dr. David Nelson	Biology, University of South Alabama
Dr. Diane Tucker	Science & Technology Honors, UAB
Dr. Kay Worley J.D.	Alabama Power Foundation
Dr. P.C. Sharma	Physics, Tuskegee University
Dr. Shane Sharpe	Computer-Based Honors Program, University of Alabama
Dr. Adriane Ludwick	Professor Emeritus, Chemistry, Tuskegee University

Electronic Media Committee Report

Website:

I have made a number of routine updates to the website (announcements, etc…) as well as these below:

Fall Executive Report Submission Page

I updated the report submission page to gather reports for this Spring 2010 executive meeting.

Online Membership Application

As of Wednesday, March 24th, **74 people** have up-to-date memberships through the PayPal system. The current PayPal balance, however, is only $348.78 because a transfer was made to the AAS checking account for the amount of $3,585.71.

Journal of the Alabama Academy of Science Indexing

I worked with Brian Burnes to investigate our options for indexing the journal with Medline and PubMed. Eventually we decided indexing with Google Scholar might be the easier approach that would also allow us to index all articles instead of the medical specific articles.

Respectfully submitted,
Brian Toone
Electronic Media

D. Old Business D

E. New Business E

F. Adjournment F

Authors Index

Innovative Solutions for the Evolving Classroom

BROOKS/COLE CENGAGE Learning

Aplia Biology

Improve comprehension and outcomes by increasing student effort and engagement!

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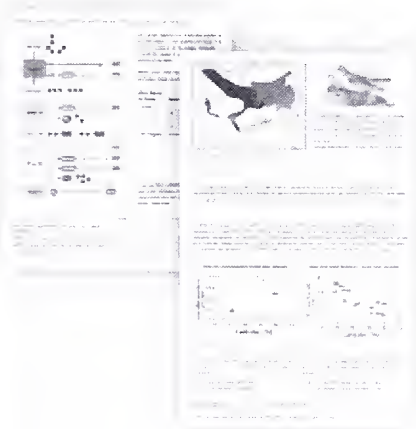
Straightforward language, a simple and intuitive user interface, and online material that works hand-in-hand with specific biology texts from Cengage Learning, **Aplia** is the online program that reinforces course concepts and encourages students to think and learn.

Active Reinforcement

Aplia is an online, interactive learning solution that makes it easy to assign automatically graded problems that keep students on track throughout the term.



Interactive Figures

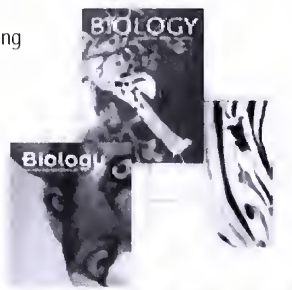
Vivid images with related questions help students come to class prepared and ready to participate.

Key Concepts

Interactive assignments and tools ensure that students succeed in grasping and applying fundamental course concepts.

Exercises Designed for Biology

Aplia's text-specific problems offer a variety of question types, including research-based exercises, and encourage students to think critically.



Aplia is available with:

- Russell/Hertz/McMillan: *Biology: The Dynamic Science,* 2/e
- Solomon/Berg/Martin, *Biology,* 9/e
- Starr/Evers/Starr, *Biology: Concepts and Applications,* 8/e

More than a million students have succeeded with Aplia. Check out Aplia at www.aplia.com

Alabama Academy of Science Journal

Scope of the Journal:

The Alabama Academy of Science publishes significant, innovative research of interest to a wide audience of scientists in all areas. Papers should have a broad appeal, and particularly welcome will be studies that break new ground or advance our scientific understanding.

Information for the Authors:

- Manuscript layout should follow the specific guidelines of the journal.
- The authors are encouraged to contact the editor (E-mail: sah@jsu.edu) prior to paper submission to obtain the guidelines for the author.
- At least one author must be a member of the *Alabama Academy of Science* (except for Special Papers).
- The author(s) should provide the names and addresses of at least two potential reviewers.
- Assemble the manuscript in the following order: Title Page, Abstract Page, Text, Brief acknowledgments (if needed), Literature Cited, Figure Legends, Tables, Figures.

What and Where to Submit:

The original and two copies of the manuscript and a cover letter should be submitted to the following.

Dr. Safaa Al-Hamdani
Editor-Alabama Academy of Science Journal
Biology Department
Jacksonville State University
700 Pelham Road North
Jacksonville, AL 36265-1602

Review Procedure and Policy:

Manuscripts will be reviewed by experts in the research area. Manuscripts receiving favorable reviews will be tentatively accepted. Copies of the reviewers' comments (and reviewer-annotated files of the manuscript, if any) will be returned to the correspondent author for any necessary revisions. The final revision and electronic copy are then submitted to the *Alabama Academy of Science Journal* Editor. The author is required to pay $100 for partial coverage of printing costs of the article.

Alabama Academy of Science
Biology Department
Jacksonville State University
700 Pelham Road North
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